

Implementing Safety Cultures in Medicine: What We Learn by Watching Physicians

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Abstract

This study explores the workplace dynamics associated with physicians and medical mistakes. Two residency settings (i.e., surgery and intensive care) were subjected to direct observation for a period of 6 weeks, revealing a total of 46 mistakes and near-miss events. Key findings that suggest greater contextual barriers to the advancement of learning cultures in residency settings with respect to patient safety include the small number of mistakes and near misses that led to adverse patient outcomes, the high percentage of resident mistakes and near misses that occur in isolation, the prevalence of “easy to explain” mistakes and near misses, and the negative reactions of attending and resident physicians to instances of failure. Key findings that support greater opportunities for advancing learning cultures include the prevalence of commission errors over omission errors, leading to the potential for greater mistake visibility, as well as the prevalence of so-called “harmless” mistakes that provide a training opportunity for learning best practices. Taken together, the results suggest the need for a situational approach to determining how and when a learning culture founded on patient safety can be implemented and sustained. The study further demonstrates the value of qualitative methods such as the direct observation of physicians in patient safety research.

Introduction

Medical mistakes are an issue central to health care in the United States. As many as 44,000 to 98,000 hospital patients die each year as a result of iatrogenic injury.¹ The consensus is that solutions to the problem of medical mistakes lay in systems approaches that focus on the interconnected parts of the health care delivery process—as opposed to approaches that seek mainly to address or blame individual providers and their behavior.^{1,2}

Implementing a learning culture around mistakes in medicine

One component of any health care “system” is its culture, defined as the shared ways of thinking, acting, and interacting among a group of individuals.³ Scholars examining nonmedical industries such as aviation and nuclear safety have identified the value of “cultures of safety,” which further enhance organizational learning capacity and reduce mistakes.^{4–6} The development of a learning-oriented culture in health care organizations, particularly in relation to doctors and nurses, is a key facilitator for improving the quality of care.^{1,2,7–10}

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The organizational learning literature suggests several cultural “best practices” as important learning facilitators (Table 1).^{3, 11–14}

Physicians who engage in these learning practices increase the likelihood that medical mistakes, near misses, and lapses in patient safety will be detected in a timely manner, providing added opportunity for reflection and identification of the underlying causes. Additionally, their participation further ensures that the contributing factors will be addressed, and that the larger delivery-of-care system is reconfigured to reduce the probability of a recurrence. In theory, immersion in a learning culture turns physicians into thinkers as well as problem-solvers, and change agents rather than defenders of the status quo.¹ Their involvement also makes the physicians more proactive clinical leaders, capable of directing other health care personnel in the adoption of a systems approach to safety.²

Table 1. Individual and group “best practices” associated with a learning culture around mistakes

Best practice *	Definition
Individual practices:	
Habit of inquiry	Willingness to engage surrounding individuals (superiors, peer colleagues, nonphysician co-workers) with respect to asking questions around mistakes, patient safety, and correct ways of doing work. Tendency to ask “why” in addition to “how” around the processes for identifying, investigating, and resolving mistake and near-miss situations.
Self-reflection	Extended self-examination of near misses and mistakes, in particular around how the near miss or mistake is being conceptualized by the individual and the larger lessons to be learned from it.
Personal forgiveness	Willingness to forgive oneself for committing a near miss or mistake, not excusing one’s part in the incident but not letting the event create untrue or exaggerated beliefs in the individual’s mind.
Expressions of doubt and fallibility	Willingness to reveal to oneself and others concerns over “knowing all the right things” or “making a mistake.”
Sharing experiences	Regularly communicating to others personal stories and experiences about near misses and mistakes committed.
Empathy toward others	Expressing feelings and concern for those in the group who make mistakes and experience failure; a “there but for the grace of God go I” mentality that allows the individual to gain understanding from someone else’s experience.
Systems thinking	Thinking about or couching episodes of mistake or failure within the context of the total surrounding system of care, as well as contextual features of the individual’s work life (e.g., fatigue) that may serve as contributory factors. Willingness to develop logics that link contextual factors to increased probability for the mistake or failure.

Table 1. Individual and group “best practices” associated with a learning culture around mistakes, cont.

Best practice *	Definition
Group practices:	
Feedback	Higher levels in the training hierarchy communicating down to lower levels specific aspects of why something is a mistake. Whether or not that communication is positive, negative, or valuable to lower levels, the communication provides information that allows the lower levels to understand the point of view and “norms” of higher levels.
Collaborative inquiry	Adopting a collective approach to uncovering, examining, and resolving a mistake or near-miss problem. Employing a flattened rather than purely hierarchical approach to gaining and assessing information around the problem.
Reciprocal communication	Communication moving both from top-down and bottom-up throughout the team, with less experienced members afforded equivalent chances of injecting their views, concerns, etc.
Creative tension	Disagreements in the group are tolerated, listened to, and resolved not by fiat but by trying to reach consensus, not limited to consensus of the most experienced individuals in the team. The group tolerates debate and disagreement where uncertainty is high around a mistake or near miss, using that disagreement to generate a variety of explanatory interpretations.
Real-time experimentation	Willingness for the group as a whole, spearheaded by higher levels in the training hierarchy, to recast mistake or mistake events in a way that questions the underlying assumptions upon which the work leading to that mistake or mistake is done.
Real-time briefings	Willingness of higher levels in the training hierarchy to, at the moment a mistake is discovered or heard about, take a constructive approach to educating lower levels around ways to lessen the probability for such a mistake to happen again in the future.

* These best practices are derived either explicitly or implicitly from a variety of management writings on the topic of learning organizations from scholars such as Senge (1990), Argyris (1991, 1996, 1999), Schein (1992), and Schon (1983).

Arguably the most important time in a physician’s career to ingrain a knowledge and use of learning-oriented practices is during residency training, when long-term mindsets about clinical practice and professional role behavior are formed.^{15–17} There is evidence to indicate that learning cultures are absent from most residency programs, as residents and attending physicians often are found to be lacking the practices listed in Table 1.^{18–23}

Dependence of a learning culture on mistake type and surrounding context

The practices listed in Table 1 cannot occur in a vacuum. Their presence is dependent upon contextual features in the everyday work environment, much as any organizational culture is shaped by the larger circumstances of which it is a part²⁴ (pp. 138–141). What conditions are important for establishing learning cultures around mistake and safety prevention in medical residency work settings?

The *type of mistake or failure situation* is one contextual variable that affects whether or not the practices in Table 1 occur. This is because the different classifications of participant mistakes shapes resulting interactions within the clinical team. For example, in Bosk's study of surgical residency,¹⁸ "technical" and "judgmental" mistakes made infrequently by the same resident necessitated a more forgiving and participative type of teaching approach than did "normative" mistakes involving resident violations of attending protocol (which provoked angry, punitive responses, regardless of their frequency). Residents also tend to think about and categorize mistakes in a way that predetermines different types of attitudinal and behavioral responses to them.²⁵ In this regard, mistakes attributed by residents to "less controllable" decisionmaking parameters or adverse work circumstances (e.g., fatigue) are more easily dismissed and are less likely to result in behavioral change.^{22, 25}

The *severity of the mistake* also shapes learning capacity within a medical culture. For example, mistakes that do not result in adverse patient outcomes may provide a greater opportunity for learning experiences to occur than do the more severe mistakes. The aviation industry has demonstrated that less severe mistakes and near misses provide psychologically safer, lower-risk (to the individuals involved) settings in which to approach practices that require a degree of self-admonition, group tension, disagreement, and blame and where assumptions about how work gets done can be challenged and debated.^{5, 26}

The level of *everyday contact between attending and resident physicians* helps to determine the degree to which a learning culture can exist in mistake-prone residency programs. As discussed previously, many of the best practices listed in Table 1 require the involvement of individuals with a mutual exposure to mistake situations. This helps to guarantee the availability of accurate information surrounding the mistake itself. In addition, frequent and positive interactions throughout the workday between members of a group—and individuals of unequal status, in particular—increases levels of psychological safety and trust across the group that enable members to take personal risks in opening up to superiors and competitors (e.g., fellow residents).²⁷ Over time, this safety and trust is more likely to foster group norms that favor open, honest communication with regard to mistake or near-miss situations.^{28, 29}

Even with adequate communication between attending and resident physicians, the *immediate responses of both groups* to a mistake or near miss incident have an effect on learning practices and their frequency of occurrence in the culture. Attending physician responses serve as the dominant example to

residents of how to think and act in their jobs.^{18, 20, 30} For instance, attending physicians who do not react with anger to residents who make mistakes, or those who make known their desire to know more about the circumstances surrounding a mistake, may encourage the residents to open up and discuss a particular event more freely. This behavior encourages learning practices such as dialogue, feedback, real-time briefings, inquiry, and creative tension. Conversely, if a resident commits a mistake in isolation and responds by repressing or rationalizing it, the opportunity for learning practices such as self-reflection, inquiry, empathy, and acknowledgment of doubt is diminished.^{19, 22, 25}

Finally, those *factors that overtly facilitate the mistake or near miss* help determine which types of learning practices manifest themselves in a given mistake situation. For example, given the competing demands and time constraints faced by attending and resident physicians in the course of a normal workday, learning practices requiring an extended time commitment will occur less if an overt cause for a resident mistake involves something perceived as “easily fixable” by the clinical team.^{31, 32} For a surgeon, an easily fixed cause of mistake could be the lack of opportunities in which to practice their technical skills. The logic for this tendency to oversimplify the mistake explanation is rooted in the notion of organizational defensive routines.^{33, 34} The defensive routine at work when attending and resident physicians quickly identify one particular mistake facilitator at the expense of other facilitators involves an assumption that there is a single, easily implemented solution that will minimize the potential for the mistake to recur again in the future (e.g., getting more operating room time so surgeons may perfect their skills).

Watching medical work to understand medical mistakes

Comprehending failure and mistakes in any line of work requires a firsthand appreciation for the different ways the error might play out in different situations. Quantitative approaches to studying medical mistakes often involve retrospective analysis (i.e., attempting to grasp the nature of the event after it has transpired). Inevitably, some meaningful degree of precision regarding the event and the investigator’s ability to fully understand it is lost. Qualitative methods, such as direct observation of medical mistakes in real time allow researchers to gather data that speaks to the process surrounding the mistake event (e.g., how individuals behave in the minutes leading up to and away from the mistake, how they interpret it, and what organizational conditions nurture or stunt fallout from the mistake). Understanding the work situations that precipitate mistakes and failures, and the variety implicit in the types of mistakes that occur in venues such as hospitals, are advantages offered by qualitative approaches. The downside to such an approach is the extensive time commitment required of the researcher, which can be intrusive and can render less useful those findings obtained in a less-than-systematic manner.

For this study, which is concerned with safety culture, direct observation is the preferred method of investigation. Despite its shortcomings, this method places the researcher in intimate contact with each mistake event. The close contact

permits mistakes to be viewed distinctly, each different from the next, and each event unfolding from a unique set of circumstances witnessed by the researcher. Viewing each mistake as a unique event enables the researcher to more easily describe the circumstances surrounding an event's occurrence and to use those descriptions as a tool for uncovering meaningful commonalities across events. As patterns emerge, the researcher can begin to understand which cultural dynamics facilitate learning, which do not, and which mistake events lend themselves to the practice of a learning culture.

This study explores the roles of mistake types and the surrounding context in shaping overall learning capacity within the medical residency culture. Three research questions are pursued:

- a) What types of mistakes and near misses do medical residents make?
- b) What are the contextual features surrounding resident mistakes and near misses, and are different types of mistakes and near misses associated with different contextual features?
- c) Are there patterns in the types of mistakes made and the surrounding contextual features that speak to the potential for residency programs to function as learning cultures?

Methods

The study examines two different residency settings at one northeastern academic medical center, using a single-case, longitudinal design with multiple qualitative methods. A key strength of the qualitative approach is its ability to embed a particular phenomenon (in this case, resident mistakes) within the contextual dynamics that surround its occurrence.³⁵ The care settings selected for observation were the trauma/general surgery unit and the medical intensive care unit (MICU). Both surgery and the MICU are mistake-prone, high-uncertainty environments.¹⁸ This makes them ideal for observing a range of mistakes and mistake situations.

The surgical team was observed during August and September 2002. The MICU team was observed during January 2003. Membership in both the surgery and MICU teams remained stable over the observational period. The trauma surgery clinical team consisted of four staff attending physicians (all surgeons trained in trauma care and general surgery), a chief surgical resident, a senior surgical resident, one surgical intern, and two fourth-year medical students (n = 9). The MICU team consisted of one attending physician (an internist trained in pulmonary medicine), a pulmonary fellow, a chief resident (internist), three interns (one each from emergency medicine, orthopedics, and family medicine), and two fourth-year medical students (n = 8).

Members of the teams were observed throughout their work shifts, for a period of three weeks. Observations averaged 6 to 8 hours per day in the case of the surgery team, and 4 to 5 hours per day in the case of the MICU team. Within

surgery, the observed work activities included morning “prerounds” involving residents and students; the morning teaching rounds with residents, students, and attending physicians; surgical procedures in the operating room; minor surgical procedures accomplished on the inpatient floor; intern, student, and resident “scut work” duties (e.g., checking postoperative surgical wounds, retrieving and reviewing diagnostic tests, and managing patient transfers) throughout the day; as well as evening rounds. Twenty-five surgical procedures of varying complexity were observed. Within the MICU, the majority of time was spent observing prerounds (which do not include the attending physician), afternoon “scut” work (e.g., retrieving and reviewing diagnostic tests, being the first contact for emerging ICU patient issues, and monitoring ICU patient status), and morning teaching rounds, the latter often lasting three hours or more per day.

Situations with a high potential for mistakes or near misses were sought out. Twenty mistakes and near misses were observed in the surgical environment, while 26 were observed in the MICU environment. The details of observed mistakes and near misses were examined each evening for their various contextual features. Interviews were conducted after each observational period with as many members of each medical residency team as possible, resulting in 15 interviews across the MICU and trauma surgery settings. The interviews were used to validate and illuminate the observational findings.

Data analysis and interpretation

Field notes were transcribed in the evening following an observational event to maximize recall. Each day’s notes were treated as separate texts and were analyzed using the Atlas.ti[®] qualitative analysis coding software. This treatment of individual observation days as “cases” is appropriate, given the grounded theory methodology that was used to analyze the data.³⁶ In addition, interviews were recorded and transcribed onto a computer for Atlas.ti analysis. Preliminary analysis was performed each night during the observation periods. In this analytic process, a taxonomic approach to categorizing mistakes and near misses was employed.³⁷ This approach used descriptions of specific mistakes and near misses for each observational day, which were then categorized using labels from the medical mistakes literature, such as mistakes of “commission” versus “omission,” and “judgmental” versus “technical.”^{1,9}

Once preliminary findings for each residency setting had been completed, an established group of clinical advisors within the academic medical center was convened to review and comment on the findings. These were summarized in a descriptive grid containing the same information for each observed mistake and near miss. The use of expert panels enhanced the “believability” of the findings, a necessary criterion in all forms of qualitative work.³⁸ The advisors included the two M.D. co-investigators and the hospital’s directors of pharmacy, medicine, and nursing, as well as the chair of pediatric surgery and two general internists.

Results

Tables 2 and 3 list the mistakes and near misses committed by the trauma surgery and MICU clinical teams during each 3-week observation period. In the surgery group, the investigators identified 20 mistakes and near misses with adequate information on the surrounding context and reactions of attending and resident physicians. There were 26 mistakes and near misses with the same criterion identified in the MICU group. Key similarities across the two resident groups included (a) the low percentage of mistakes that led to adverse patient outcomes, (b) the wide variety of mistakes and near misses occurring within each identified mistake category, (c) the isolated nature of most mistakes and near misses (e.g., the resident committed the mistake while alone, versus in a group), (d) the lack of what might be termed “supportive” responses from attending physicians to resident mistakes and near misses, and (e) the knowledge and technical skills deficits that were common “overt” facilitators of the mistake or near miss.

Key differences between the surgery and MICU resident teams included the following: (a) more mistakes of commission than omission in surgery, with the opposite holding true in the MICU; (b) more technical than judgmental mistakes occurring in surgery, with the opposite holding true in the MICU; (c) a higher percentage of mistakes and near misses revealed to attending physicians in the MICU case, with the opposite holding true in the case of surgery; (d) more attending physician responses that could be defined as “neutral” rather than “angry” in the MICU case; and (e) more resident responses that could be defined as “rationalizing the mistake” in the surgery case. Two-thirds of the surgery mistakes and near misses involved mistakes of commission. Most of these involved actions during surgical procedures, for example, the resident experiencing difficulties in the insertion of a trachea tube or cutting a blood vessel while using laparoscopic instruments. Nine of the 13 (69 percent) commission mistakes and near misses were identified as technical (i.e., improper execution of a proper clinical step or decision) rather than judgmental (i.e., the wrong plan of action or decision taken for a patient’s care). Surgery residents believed that technical mistakes were a normal part of the surgical role:

“My work essentially involves assaulting patients, cutting into them, taking something out of them, fixing something inside them, whatever. That’s my primary job, to know when to operate on someone, when to cut into someone. If I make mistakes in the course of that job, then it logically should involve doing something in that assault on the patient incorrectly.” — Senior surgery resident

Table 2. Types of mistakes and near misses observed during surgical observations (n = 20)

Type of mistake	Where	Description	Alone or with group?	Facilitating factors	Adverse outcome for patient?	Immediate resident response	Attending response
Commission/ judgmental	Floor	Ordered a wrong type of patient x-ray	Alone	Knowledge deficit	No	Casual, believed it was an isolated incident	N/A – attending did not discover mistake
Commission/ judgmental	Floor	Wrong plan for changing patient's chest tube dressing	With nurse	Knowledge deficit	No	Casual, believed it was an isolated incident	N/A – attending did not discover mistake
Commission/ technical	OR	Blood vessel cut during a laparoscopic procedure	Group	Time, technical skill	Yes	None	Got angry with resident
Commission/ technical	OR	Twice inserted a breathing tube incorrectly into patient's trachea	Group	Time, fatigue, technical skill	No	None	Got angry with resident
Commission	Floor	Incorrect dosage was written on a patient drug script	Alone	Not discernable	No	Corrects mistake in pharmacy and forgets	N/A – attending did not discover mistake
Commission/ technical	Floor	Incorrect dosage was written on a patient drug script	Alone	Knowledge deficit	No	Corrects mistake in pharmacy and forgets	N/A – attending did not discover mistake
Omission/ judgmental	Floor	CT scan was not reviewed in a timely manner	Alone	Not discernable	Not discernable	Not discernable	Got angry with the entire resident team
Omission/ judgmental	Floor	Proper follow-up testing was not done following a negative lab result	Alone	Knowledge deficit	Not discernable	Casual, believed it was an isolated incident	Reminded resident one-on-one of need to do follow-up testing
Omission	Floor	A lab test is ordered, but the results are never documented in chart	Alone	Not discernable	No	Casual, believed it was an isolated incident	N/A – attending did not discover mistake

Table 2. Types of mistakes and near misses observed during surgical observations (n = 20), cont.

Type of mistake	Where	Description	Alone or with group?	Facilitating factors	Adverse outcome for patient?	Immediate resident response	Attending response
Omission	Floor	CT scan order forms were not properly completed and sent to diagnostic imaging	Alone	Not discernable	No	Casual, believed it was an isolated incident	N/A – attending did not discover mistake
Omission/ judgmental	Floor	Night resident failed to notify morning relief of an overnight transfer involving a trauma patient with an amputated leg	Alone	Not discernable	Not discernable	Not discernable	Got angry with the entire resident team
Omission/ judgmental	Floor (ICU)	Ordered central access line had not been installed overnight	Alone	Technical skill, knowledge deficit	No	Not discernable	Got angry with the entire resident team
Omission	Floor	Signed physician order sheet is left blank, delaying completion of order	Alone	Not discernable	No	Casual, believed it was an isolated incident	N/A – attending did not discover mistake
Near miss – commission/ technical	Floor (ICU)	Installation of breathing tube into patient's trachea was delayed	Group	Technical skill, knowledge deficit	No	Rationalizes – end was justified by problems in the means	Supportive – talks resident through procedure and lets him perform it
Near miss – commission/ technical	OR	Blood vessel was unintentionally clamped too tightly during laparoscopic procedure, but later was released	Group	Time, technical skill	No	None	Attending got anxious and angry with resident

Table 2. Types of mistakes and near misses observed during surgical observations (n = 20), cont.

Type of mistake	Where	Description	Alone or with group?	Facilitating factors	Adverse outcome for patient?	Immediate resident response	Attending response
Near miss – commission/technical	OR	Stitch was tied incorrectly during a laparoscopic procedure	Group	Technical skill	No	None	Attending got anxious and angry with resident
Near miss – commission/technical	Floor (ICU)	Needle was nearly pushed through patient's trachea wall during a trach procedure	Group	Technical skill	No	Rationalizes – end was justified by problems in the means	Attending prevents mistake and talks resident calmly through procedure
Near miss – commission/technical	Floor (ICU)	A guidewire was nearly pulled completely through the stomach during a trach and peg procedure	Group	Technical skill, knowledge deficit	No	None	Attending prevents mistake; scares resident with the "bad outcome"
Near miss – commission/technical	OR	Wrong area was nearly cut during a gall bladder removal	Group	Technical skill, knowledge deficit	No	None	Attending prevents mistake; no reaction or feedback
Near miss – commission/judgmental	Floor (ICU)	Wrong area of patient's belly was nearly cut during a peg procedure	Group	Technical skill, knowledge deficit, time	No	None	Attending prevents mistake; takes over procedure, forgives resident

Definitions:

Omission – failure to perform a step one is expected to perform; missing a necessary action step in the care process

Commission – performing an intended action incorrectly or performing an unintended action in the care process

Judgmental – deciding upon an incorrect or inappropriate plan of action associated with a patient's care

Technical – incorrectly performing a proper clinical step or action

Table 3. Types of mistakes and near misses observed during medical intensive care unit observations (n = 20)

Type of mistake	Where	Description	Alone or with group?	Facilitating factors	Adverse outcome for patient?	Immediate resident response	Attending response
Omission/ judgmental	MICU and ER	Failed to obtain sufficient clinical information (physical and history) from patient	Alone	Not discernable	No	Takes seriously, spends subsequent day obtaining information	Got angry with resident; orders resident to obtain information
Omission/ judgmental	MICU and ER	Failed to determine the legitimacy of a "Do Not Resuscitate" order	Alone	Knowledge deficit	No	Takes seriously, spends subsequent day obtaining information	Got angry with resident; orders resident to obtain information
Omission/ judgmental	MICU	Failure to ensure patient's comfort during a bronchoscope insertion	Alone	Time, lack of supplies in MICU	No	None	Got angry with resident
Commission/ judgmental	MICU	Patient developed acidosis in part because of improper chloride level monitoring and saline IV administration	Group	Knowledge deficit	Yes	Apologetic, surprised – asked attending physician to clarify	Supportive – shared personal, related mistake experience; lectured residents on "right" thing to do
Commission/ judgmental	MICU	Resident discontinued insulin prematurely for a patient with acidosis	Alone	Knowledge deficit	No	Apologetic, surprised – asked attending physician to clarify	Supportive – attending provides clinical teaching to have residents learn
Omission/ judgmental	MICU	Resident missed a pulmonary edema diagnosis	Alone	Knowledge deficit	No	Apologetic, surprised – asked chief resident to clarify	N/A – attending did not discover mistake

Table 3. Types of mistakes and near misses observed during medical intensive care unit observations (n = 20), cont.

Type of mistake	Where	Description	Alone or with group?	Facilitating factors	Adverse outcome for patient?	Immediate resident response	Attending response
Omission/ judgmental	MICU	Failed to order appropriate diagnostic test at needed intervals	Alone	Knowledge deficit	No	Resident pushes attending for explanation, after initially denying mistake	Supportive – attending provides clinical teaching so residents will learn
Omission/ judgmental	MICU	Failed to conduct physical exam on patient, as part of differential diagnosis process	Alone	Not discernable	No	None	Neutral - attending provided clinical teaching; shares past experiences of exam usefulness
Omission/ judgmental	MICU and ER	Failed to perform ear exam on unconscious patient brought into hospital's ER	Alone	Knowledge deficit	No	Takes seriously, resident repeats exam on patient during evening rounds	Got angry with resident – extended questioning of resident, then provided clinical teaching
Commission/ judgmental	MICU	Resident administered a drug to treat gout that can cause gastritis	Alone	Knowledge deficit	No	Rationalized – cannot be expected to know everything and mistakes do happen	Not discernable
Omission/ judgmental	MICU	Failed to order uric acid test on MICU patient in a timely manner	Alone	Not discernable	No	None	Neutral – extended questioning of resident, then provided clinical teaching
Omission/ judgmental	MICU	Failed to check patient's antibiotic levels at required intervals	Alone	Knowledge deficit	No	None	Neutral – attending tells resident to “just do it” each morning

Table 3. Types of mistakes and near misses observed during medical intensive care unit observations (n = 20), cont.

Type of mistake	Where	Description	Alone or with group?	Facilitating factors	Adverse outcome for patient?	Immediate resident response	Attending response
Omission/ judgmental	MICU	Failed to do appropriate diagnostic tests on ER patient in a timely manner	Alone	Not discernable	No	Resident made excuses to attending about why tests were not performed	Neutral leading into anger with resident
Omission/ technical	MICU	Failed to sterilize patient's neck area with betadine before catheter was inserted	Alone	Not discernable	No	Casual – did not think it was a “big deal”	Attending got angry with resident – questioned him in a curt manner
Omission/ judgmental	MICU	Failed to obtain all appropriate clinical information during patient evaluation	Alone	Not discernable	No	None	Got angry with resident
Commission/ technical	MICU	Failed to adequately suture a triple lumen femoral line inserted into patient	Alone	Time, technical skill	No	Not discernable	Got anxious and angry with resident – threatened to pull procedure from resident control
Commission/ judgmental	MICU	Treated patient with too much bicarbonate, causing alkalosis	Group	Knowledge deficit	Yes	None	Neutral leading into anger with residents
Commission/ judgmental	MICU	Patient's mechanical ventilator was set incorrectly for weaning patient from machine	Alone	Knowledge deficit	No	Casual, believed it was an isolated incident	N/A – attending did not discover mistake
Commission/ technical	MICU	Failed to correctly insert breathing tube into patient being put on mechanical ventilation	Group	Technical skill, knowledge deficit	No	None	Prevented mistake; took over procedure; no reaction or feedback

Table 3. Types of mistakes and near misses observed during medical intensive care unit observations (n = 20)

Type of mistake	Where	Description	Alone or with group?	Facilitating factors	Adverse outcome for patient?	Immediate resident response	Attending response
Commission/technical	MICU	Failed to correctly insert guide wire into patient during catheter insertion procedure	Alone	Technical skill, time	No	None	Got anxious and angry with resident – took over procedure
Omission/judgmental	MICU and ER	Failed to perform appropriate diagnostic tests in a timely manner	Alone	Knowledge deficit	No	None	Neutral – extended questioning of resident, then provided clinical teaching
Near miss – omission/technical	MICU	Failed to list drug dosage on patient's medication order	Alone	Not discernable	No	Casual, believed it was an isolated incident	N/A – Attending physician did not find out, nurse caught error
Near miss – omission/technical	MICU	Failed to list time for a PRN order	Alone	Not discernable	No	Casual, believed it was an isolated incident	N/A – Attending physician did not discover mistake, nurse caught error
Near miss – omission/judgmental	MICU	Wrote incorrect discontinue order for patient's insulin drip	Alone	Knowledge deficit	No	None	N/A – Attending physician did not discover mistake, another resident caught and fixed it
Near miss – commission/judgmental	MICU	Wrote incorrect dosage on a patient drug script	Alone	Not discernable	No	Casual, believed it was an isolated incident	Neutral –attending physician prevented mistake by correcting dosage
Near miss – commission/technical	MICU	Order for Lasix was written up twice	Alone	Not discernable	No	Casual, believed it was an isolated incident	N/A – Attending physician did not discover mistake, nurse caught error

In the case of the MICU resident team, nearly two-thirds (16/26) of observed mistakes and near misses were the result of the residents' failure to do something they should have done (i.e., mistakes of omission). Thirteen of the 16 (81 percent) involved errors of judgment, (i.e., an inappropriate or incorrect plan of action for the patient). In one instance, a particular diagnostic test on a patient was not obtained at the appropriate interval (i.e., each day, rather than every second day) because the resident incorrectly judged the daily testing interval to be unnecessary. The chief resident in the MICU echoed the sentiments of his team members in asserting that the management and interpretation of large amounts of clinical data were at the root of judgmental mistakes made by residents:

"Our primary job (in the MICU) is to learn how to manage a complex data set. To make sense out of it and apply it for the benefit of the patient. However, residents are the least likely to be able to manage that data correctly all or even most of the time. Because they have the least experience using this information. And that leads to bad decisions being made." — MICU chief resident

In surgery, the remaining third of mistakes and near misses involved mistakes of omission. Examples of omission mistakes among surgical residents include a failure to review imaging tests such as CT scans in a timely manner and a failure to include appropriate documentation in the patient's chart for a lab test. Similar to the MICU case, the majority of omission mistakes were deemed judgmental, (i.e., residents deciding on an incorrect or inappropriate plan of action for a patient's care) and resulted in the residents' failure to do something they should have done (had they first determined the correct plan of action). Mistakes of commission, however, differed in type between the surgery and MICU teams. In surgery, these types of mistakes often occurred in the act of operating directly on patients, while in the MICU the mistakes of commission included incorrectly written pharmacy orders, incorrectly administered medications and IV treatments, and the improper use of medical equipment. In this way, more of the MICU team's mistakes and near misses were regarded as lapses of judgment, rather than lapses of technique.

Both teams exhibited a high level of variation in the types of mistakes made within the larger categories (i.e., omission, commission). Seventeen different types of mistakes and near misses were observed within the surgical resident group. Of the 26 total mistakes and near misses observed in the MICU group, 23 were unique in type. This notion of mistake variation was supported by the interviews, in which the residents from the surgery and MICU groups claimed they were not prone to making one type of mistake more often than any another. Moreover, very few of the mistakes committed by members of either team resulted in adverse patient outcomes (Tables 2 and 3). Of the 17 instances in which it was possible to track a surgery team mistake or near miss through to its final outcome, just 1 adverse event (6 percent) was found to have occurred. Among the MICU team members, 8 percent of mistakes and near misses led to adverse events.

Both resident teams had little opportunity for real-time group interaction following a mistake or near miss. Just 3 of the 26 (12 percent) MICU team mistakes and near misses occurred in a group care situation, (i.e., where others on the team could witness the mistake or near miss as it occurred). Half of the 20 surgery team resident mistakes and near misses occurred in isolation, (i.e., where no other health care personnel could witness the event). In this way, the observed mistakes and near misses often were solitary experiences for particular residents. Surprisingly, 15 of 20 (75 percent) surgery team mistakes and near misses occurred on the hospital floor and not in the operating room (OR). In interviews with the surgical residents, a link was implied between the high percentage of mistakes occurring both in isolation and on the hospital floor. This link involved the perceived importance among residents—especially senior residents—of gaining OR experience at the expense of all other work duties.

“The goal in surgery, if you’re not an intern, is to finish up your floor work quickly, and minimize it, so that you can get to the OR and spend as much time as you can doing procedures. This limits interaction time between all of us. I mean, you don’t want to be interacting too much with other surgical residents because then you probably aren’t doing what you need to do to become a good surgeon. And if you are senior, you have paid your dues on the floor and expect interns to take care of that stuff on their own.”

— Senior surgery resident

In addition, 7 of the 15 observed floor mistakes and near misses were never discovered by a senior resident. This could be attributed to the fact that none of the mistakes and near misses that occurred in isolation was associated with an adverse patient outcome. That is, such mistakes and near misses had lower costs (for the resident) associated with concealing them from other members of the surgery team.

“I develop a hierarchy of mistakes in my head. The most serious ones obviously are those with the worst patient outcomes. You can’t ignore those, or you’ll be in big trouble. In that situation, you have to get everyone onboard the boat; there can’t be any surprises. But ones that don’t do the patient any harm? Maybe they get caught before they happen, like giving someone a wrong drug dose. Well, those kinds I’d still probably blow off, even with more experience.” — Surgery intern

In the MICU group, although a higher percentage of errors occurred in isolation, 19 of 21 observed mistakes (near misses excluded) were discovered by the MICU attending physician, usually the next day or several days later. The long morning rounds in the MICU environment may account for this finding. Unlike the surgery group, the attending physician in these rounds had to solicit a lot of clinical information from the resident to satisfy the documentation requirements of the MICU work environment. And in this situation, the costs to a resident of hiding a mistake was much higher—even if it did not lead to an adverse event—than in the surgery group, where patient rounds had a tendency to

be more abbreviated. Another reason might be the nature of the mistakes themselves (i.e., more mistakes of omission that were judgmental in nature). This variety of mistake required the residents to interact with the attending physician (e.g., for the purpose of obtaining information on the correct course of diagnostic or treatment activities for a given patient), lest the same mistake happen again. In the MICU, as opposed to surgery, there appeared to be a deeply entrenched cultural norm that required residents low in the training hierarchy to communicate directly with the attending physician, rather than with the senior or chief resident.

“I tell the residents from the first day they get here (in the MICU) that they are to let me know about everything that might be important. Even the interns. If they need to contact me directly about something they are not sure of or concerned about, they need to do it. At some point, they will have to tell me anyway, and if it’s later it’s not the point at which we can necessarily do anything about it for the patient.” — MICU attending physician

In the case of surgery, nearly all resident responses immediately following a mistake or near miss fell into one of three categories: (1) a “casual” response, dismissing the incident as something that could never occur again; (2) a “rationalizing” response, concluding that while a mistake or near miss did occur, a favorable patient outcome made the incident a “nonissue”; and (3) no response (i.e., the resident did not acknowledge the need for additional thought or action, after the mistake or near miss had occurred). Thus, all the discernable resident responses involved few overt or sustained reactions. These responses did not appear to be associated with specific types of mistakes or near misses. Surgical residents, however, were likely to exhibit “no response” to a mistake or near miss in situations where the attending physician was present when the mistake was discovered or was told about it soon afterwards. This absence of response was common to the MICU team, as well. Physicians in both settings hinted at an explanation for this silence:

“When you make a mistake, it’s usually better just to shut up and not say anything. Let the attending tell you what you did wrong. You’ve already screwed up, so you don’t want to make it worse by saying something that will piss the attending off. And usually after the attending has addressed it, I try not to dwell on it again.” — Surgery intern

“When a mistake happens and the attending sees it or learns about it, you don’t have time to sit back and think about a way to respond. You’re usually scared as hell because you made the mistake and it’s a reflection on you. So, I just keep quiet and take my cues from the attending. I might be more vocal with the senior resident, but not with the attending.” — MICU intern

Both groups were fearful of being perceived as incompetent by attending physicians. This fear was manifest because of the perception within both residency programs that many resident mistakes had clear facilitating factors

associated with them that involved either technical or knowledge deficits on the part of the resident (see below).

Resident responses unique to the MICU team involved (a) being apologetic and looking to the attending to clarify why the resident made the mistake, and (b) taking the mistake or near miss seriously, often expressed through a subsequent investment of time and energy, with a goal of correcting the error. Again, the MICU-specific responses appeared to be tied closely to the judgmental, rather than technical, nature of mistakes and near misses, in which residents needed answers from senior physicians to help prevent a recurrence. In mistake and near miss situations of a more technical nature, the MICU residents exhibited responses similar to those of the surgical residents.

Attending physician responses were similar across the two clinical teams, with respect to the much lower percentage of “supportive” reactions. Of the 13 incidents involving the surgery team in which attending surgeons discovered or were present during the mistake or near miss, 7 of the immediate responses could be classified as “getting angry at the resident or resident team.” For example, a chief resident who caused bleeding in a patient’s abdomen by cutting a blood vessel during a laparoscopic gall bladder removal received a stern and animated response from the attending physician who took part in the surgery.

These types of negative responses usually thwarted any type of immediate resident response to the mistake or near miss among those on the surgery team, as shown in Table 2. Attending responses did not appear to be related to particular attending surgeons. In interviews, attending surgeons suggested that the circumstances surrounding different mistakes often called for different responses, mainly because some mistakes were more “serious,” while others were more “excusable” (in the attending physician’s opinion). Thus, they justified their situational approach to mistake responses through a rationale of how they perceived a particular type of mistake—rather than how they should respond in order to create the best possible learning environment for the resident.

“You can’t look at it all the same. You excuse different things that are done wrong a bit more, depending on the level of the (surgical) resident. For example, a junior resident should not be making intern mistakes. Some mistakes are also much less excusable, in the sense that there’s no reason for any resident to make them, like ones that result from being unclear about how to proceed with a patient care situation. Or ones where the resident clearly should be able to do something, given his experience, but can’t.”

—Attending surgeon

Among members of the MICU clinical team, 9 of 20 (45 percent) observable attending physician responses were classified as “angry,” while 6 of 20 (30 percent) were labeled as “neutral” in that no discernable positive or negative response was seen. Rather, the latter responses were viewed as dispassionate. While there was extended clinical teaching connected to the “angry” attending physician responses in the MICU group setting, there was no observed teaching

associated with the errors and near misses that prompted the angry responses in the surgery group. No discernable pattern could be found among either team that linked the angry responses to a particular type of mistake or mistake context. Finally, the observations consisted of attempting to identify overt “facilitating factors” that might have played a meaningful role in the occurrence of a mistake or near miss. Nearly all of the mistakes and near misses across both resident teams appeared to be facilitated by overt knowledge or technical skill deficits on the part of individual residents (Tables 2 and 3).^{*} In both groups, the deficits did not appear related to the type of observed mistake or near miss. In just a few instances were there mistakes or near misses with overt facilitating factors that were not associated with shortcomings in resident clinical knowledge or technical acumen.

Discussion

This study highlights the importance of mistake types, the context of mistakes, and their ability to shape learning capacity within a given health care organizational culture. This adds a needed layer of complexity to the blanket statements made by authoritative bodies, such as the Institute of Medicine and the National Quality Forum, that imply that “cultures of safety” can (and must) be established across any and all medical work and mistake situations. It is more accurate to propose that there will be numerous gradations of the learning ideal (as manifested in Table 1) across work situations that aid in lesser to greater degrees in helping health care organizations minimize mistakes and enhance patient safety. These gradations are dependent upon several contextual factors, including the nature of social interaction among actors within the medical care setting, individually based attitudes and behaviors surrounding mistake events, and enabling factors such as time, the physical proximity between people, and the type of clinical work being done. This aforementioned layer of complexity further grounds the ideal of organizational learning and the goal of “cultures of safety” in the everyday realities of health care work environments.^{1, 2, 11, 12} These realities need to be taken into account when considering the opportunities and barriers for improving organizational learning capacity with respect to safety (Table 4). Specific to medical training, the findings suggest that if residency cultures in medicine are to become more learning-oriented, with regard to mistakes, the organizations in which they are embedded must become more accountable and make meaningful changes in the areas of work redesign and human capital improvement. This fits with the general idea within learning theory that organizations are responsible for providing the right conditions in which learning can occur.¹¹ To address the barriers alluded to in the aforementioned example and presented in Table 4, for example, medical residency programs would benefit from a restructuring of attending physician supervision within the residency team.

^{*}A knowledge deficit is defined as the resident committing a mistake or near miss due, at least in part, to a lack of understanding about the scientific basis for a particular clinical decision or action taken. A technical skill deficit is defined as a resident’s inability to perform a step or take action in a larger surgical procedure correctly, or performing a step incorrectly.

For the residency program, this could mean “flattening” the traditional residency hierarchy and getting attending physicians more directly involved with interns and junior residents in the course of a normal workday. Among other things, this would create greater opportunity for social interaction, while permitting fewer mistakes and near misses to go unnoticed. Such a structural change would not be successful, however, without the participation and support of hospitals sponsoring residency programs. This action could include working to improve the attending/resident staffing ratio, so that smaller spans of supervision are maintained within each residency team. Such support also could include the promotion by hospitals and residency programs of team-based approaches to patient care that redistribute the clinical work to other health care personnel, so that residents and attending physicians may spend more of their time interacting (Table 4).

The results also reveal the power of organizational “defensive routines” and their ability to undermine learning in environments centered around medical mistakes and patient safety.^{13, 33, 34} In this study, both residency programs appear to include contextual elements that indicate the likely presence of these routines. For example, most of the mistakes of commission observed among surgeons in this study included an overt facilitating factor (i.e., a technical skill deficit on the part of the resident that resulted in an inability to perform a specific step in a given surgical procedure). Given the emphasis that surgeons routinely place on the technical aspects of their work (i.e., being a “good” surgeon ultimately means being a “good” technician in the operating room^{18, 20}), resident mistakes involving a lack of technical skill could trigger a defensive routine in which the attending surgeons call for the residents to spend more of their time involved with procedures in the OR and on the floor. This would short-circuit their interest in, and use of, learning practices that uncover other latent causes of technical resident mistakes.

This study suffers from several limitations. First, there is undoubtedly some degree of reliability sacrificed in having all the observations performed by a single person. It was not feasible, however, given the intrusiveness of the data collection strategy and the anxious nature of the studied phenomenon (i.e., mistakes), to have multiple researchers performing the observations. Second, it is likely that not all mistakes and near misses were captured in this analysis. Given the clear patterns identified in Tables 2 and 3, and the reality that all relevant work situations were observed, further observations might not produce a meaningful change in the results. Finally, members of the resident groups could have behaved differently while under observation. This is unlikely, given the lack of concern expressed by members of each clinical team to the presence of the researcher, during the observational period, and the group members’ increased willingness over time to discuss their mistakes and near misses.

Table 4. Observations on the roles of mistake type and context in creating learning-oriented medical residency cultures: select examples

Select Findings	Opportunities and barriers for creating/sustaining learning cultures in residency training
Most mistakes do not lead to adverse patient outcomes	<p>Opportunity to apply interventions (with learning practices) from other industries (e.g., aviation crew resource management techniques) to a pool of “low-risk” learning situations in which mistakes are known to occur</p> <p>Creates a barrier of “perceived significance,” in that physicians may not consider a shift toward the inclusion of learning practices in cultural norms to be a matter of importance (i.e., the payoff is not worth the investment of time and energy, since most mistakes do no harm to patients)</p> <p>Creates a barrier in the form of a learning “bias,” occurring when only serious mistakes are used as learning opportunities, possibly precluding the use of learning practices such as dialogue, creative tension, reciprocal communication, and real-time feedback (i.e., serious mistakes are handled more autocratically by the residency hierarchy)</p>
Most resident mistakes and near misses occur in isolation from more experienced physicians and attending supervisors	<p>Opportunity to restructure attending-resident physician interaction during the workday, in order to create more opportunity for learning practices, through such interventions as work redesign and enhanced use of allied health personnel</p> <p>Creates a barrier around mistake “visibility” where most mistakes and near misses go undetected, leading to a smaller set of cases in which learning practices can be used and practiced; only more serious mistakes may get used for learning (see above)</p> <p>Creates a barrier in that group-dependent learning practices in the residency culture have much less opportunity to be regularly utilized, tendency to quit using practices if not mastered</p> <p>Increased risk of residents developing defensive routines such as cognitive avoidance, rationalization, etc., increased risk of physicians preferring to hide mistakes and near misses if possible, given competitive nature of residency environments</p>
A wide variety of mistakes and near misses occurring within each type of mistake category identified, within both residency settings	<p>Opportunity to increase mistake learning exponentially as same learning practices are applied across a variety of mistake situations, providing the practices themselves with more cultural legitimacy (i.e., doctors see how they can be used in any situation)</p> <p>Opportunity to compare and contrast different mistake situations with each other, creating more generalizable lessons around patient safety and mistakes</p>
Majority of physician mistakes and near misses associated at least partly with knowledge/technical skill deficits, i.e., “easy to explain” causes	<p>Creates a barrier by facilitating the use of defensive routines such as oversimplifying the root causes of resident mistakes and near misses; these defensive routines fuel the perception that learning practices are not needed around mistake situations, i.e., there is a “simple” solution to mistake problems</p>

Further exploratory work could help to illuminate the situational complexity that produces variation in learning culture capacity across health care work settings. This could be done through the type of methodology employed in this study, which was intended to paint a rich, descriptive picture of the work process and range of circumstances surrounding specific types of resident mistakes. In any event, what is now popularly termed a “learning culture” in organizational and health services literature must be regarded as less of what Senge calls a “quick fix.”³⁹ Instead, these types of cultures are cultivated through an understanding of the existing organizational work environment related to patient care, and a willingness to invest time, patience, and some degree of managerial-professional conflict in the process of initiating change.

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